

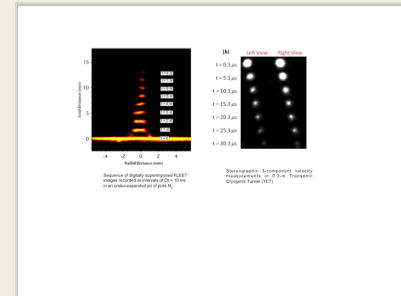
# High-Speed, Noninvasive, Multi-Parameter Laser Diagnostics for Transonic Flows, Phase II

Completed Technology Project (2015 - 2018)



## Project Introduction

Numerous ground-test and wind-tunnel facilities are used extensively to make surface measurements of and to characterize the forces and moments encountered by aeronautics test articles. Quantitative results in these test environments are required to validate the computational fluid dynamics (CFD) tools that are used to extrapolate wind-tunnel data toward realistic flight conditions and hardware. The development of fast instrumentation and measurement capabilities that can readily be integrated into the extreme conditions present under such test conditions is one of several major technological challenges associated with the design, building, and operation of these complex test environments. Among the host of physical quantities, accurate mapping of velocity flow fields remains a significant yet essential challenge in these facilities. In addition, spatially and temporally resolved measurements of other flow parameters, such as gas density, pressure, temperature, and species mixing fractions, are of paramount importance to characterize fully the fluid dynamics. Unfortunately, the widely available current suite of flow-field probes exhibit varying degrees of intrusiveness, requiring either the physical placement of probes inside the test facility or the introduction of foreign particles or gas-phase species into the flow field. Thus, the development and application of non-invasive flow-field diagnostic probe techniques is of principal importance in these environments. This proposal expands upon our successful Phase-I results and offers an integrated package of truly cutting-edge, multidimensional, seedless velocimetry and flow diagnostics for ground-test facilities. The concepts and ideas proposed range from proof-of-principle demonstration of novel methodologies using kHz-rate femtosecond (10-15 sec) and 100-kHz-rate burst-mode picosecond (10-12 s) duration laser sources to measurements in realistic tunnel conditions expected in the current solicitation.



High-Speed, Noninvasive, Multi-Parameter Laser Diagnostics for Transonic Flows, Phase II Briefing Chart Image

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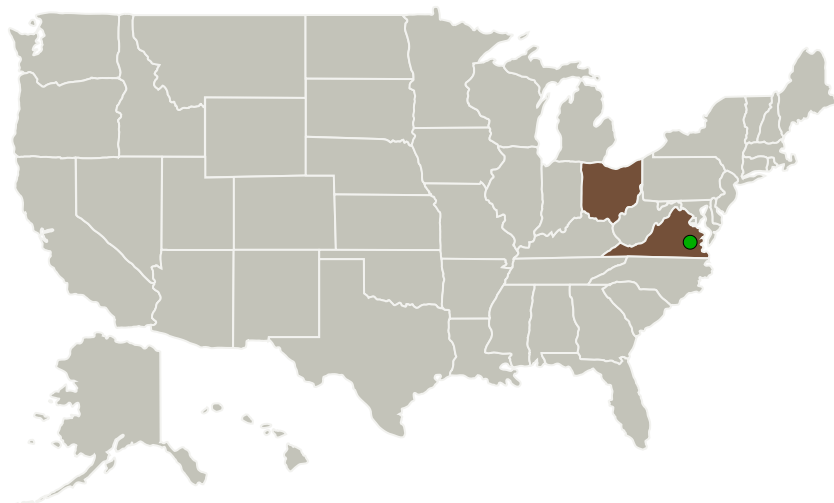
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## Primary U.S. Work Locations and Key Partners



Organizations Performing Work	Role	Type	Location
Spectral Energies, LLC	Lead Organization	Industry Small Disadvantaged Business (SDB)	Dayton, Ohio
● Langley Research Center(LaRC)	Supporting Organization	NASA Center	Hampton, Virginia

### Primary U.S. Work Locations

Ohio	Virginia
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## Organizational Responsibility

### Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

### Lead Organization:

Spectral Energies, LLC

### Responsible Program:

Small Business Innovation Research/Small Business Tech Transfer

## Project Management

### Program Director:

Jason L Kessler

### Program Manager:

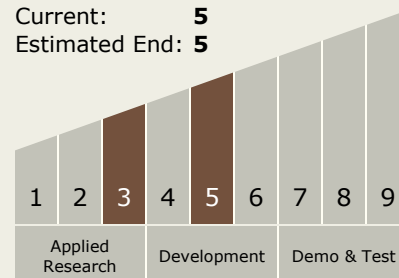
Carlos Torrez

### Principal Investigator:

Sukesh Roy

## Technology Maturity (TRL)

Start: 3  
Current: 5  
Estimated End: 5

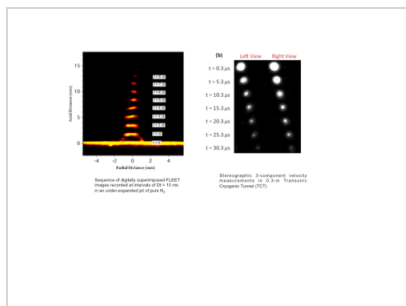


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## Images



### Briefing Chart Image

High-Speed, Noninvasive, Multi-Parameter Laser Diagnostics for Transonic Flows, Phase II Briefing Chart Image

(<https://techport.nasa.gov/image/126718>)

## Technology Areas

### Primary:

- TX15 Flight Vehicle Systems
  - └ TX15.1 Aerosciences
    - └ TX15.1.7 Computational Fluid Dynamics (CFD) Technologies

## Target Destinations

The Sun, Earth, The Moon, Mars, Others Inside the Solar System, Outside the Solar System